THE PORT AUTHORITY OF NY & NJ

WTCI-657-P

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April 14, 2004

John L. Gross, Ph.D., P.E.
Leader, Structures Group
United States Department of Commerce
National Institute of Standards and Technology
Gaithersburg, MD 20899-0001

Dear Dr. Gross:

Following are responses to your questions in your letter to Joe Englot dated April 5, 2004, which are repeated here in bold italics.

By this letter, I am requesting information from The Port Authority on fireproofing of the interior and exterior columns of the World Trade Center towers. Specifically, please provide the following:

1) ***Fireproofing material and thicknesses for the exterior columns as follows:***
- ***Plates 1 and 2 (these plates face the outside of the building and were covered by the aluminum column panels)***
- ***Plate 3 (interior plate within the occupied space)***
- ***Plate 4 (spandrel), both interior and exterior surfaces***

2) ***Fireproofing material and thicknesses for the core area box columns.***

3) ***Confirmation that the wide flange column sections were specified to be fireproofed as follows using Cafco Type DC/F:***
- ***Columns smaller than 14WF228 – 2-3/16 in***
- ***Columns greater than or equal to 14WF228 – 1-3/16 in.***

In response to your first three questions, Mr. Englot inquired throughout the Port Authority and was not able to find any information related to these questions other than that information already turned over to NIST.

4) ***Any information the Port Authority has regarding measurements of the in-place fireproofing material thickness.***

We have no records in our Materials Division of ever repairing or replacing fireproofing on exterior columns due to their inaccessibility and, therefore, have no recent thickness measurements of any re-applied fireproofing.

We have no records in our Materials Division of ever repairing or replacing fireproofing on core columns due to their inaccessibility (other than columns which are accessible within the elevator shafts) and, therefore, have no recent thickness measurements of any re-applied fireproofing for core columns.

The only records of thickness measurements we could find were for the columns that are accessible within the elevator shafts. The Port Authority Materials Engineering Division took them and they correspond to World Trade Center Tower 1 elevator shafts. Discrete readings were taken at shaft 10/11 from the basement to the 45th Floor in Tower 1 in a report dated 4/7/1999. Mean thickness values were found for shaft 14/15 from the basement to the 80th Floor in Tower 1 in a report dated 8/4/1997. These measurements cover the full extent of these two elevator shafts. One was an express from the concourse lobby to 44 with a machine room on 47 and the other was express from the concourse to 78 with an EMR on 81. The readings for both of these shafts are attached (Excel file).

Discussions with Engineering Department staff and former World Trade Department staff indicate that these two shafts had asbestos abatement and were re-fireproofed. The measurements also show a "Minimum Thickness Required" of fireproofing. Staff members recall that there was a schedule of replacement fireproofing thickness that was prepared by the firm Leslie E. Robertson Associates (LERA). One staff member located a copy of one schedule, which will be forwarded under separate cover as a sample. We have contacted William Faschan of LERA and it appears that the "Minimum Thickness Required" is the thickness called for in a schedule that appeared in documents for the work that was prepared by LERA. The sample schedule indicates that the fireproofing applied was "Type Z-106". We will try to locate the specification book for this material. This information may be among the documents that LERA assembled for NIST at the Port Authority's 225 Park Avenue South office. We will continue to search for more complete sets of this information.

In the meantime, I hope this answers your questions. Please call or reply otherwise if you need further information.

Very truly yours,

Francis J. Lombardi, PE
Chief Engineer

Att.

PA Materials Engineering

Discrete Thickness Values
Historical WTC Fireproofing
Elevator Shaft Results

Date of Report	12/23/1993	12/23/1993	12/23/1993	12/23/1993	4/7/1999	4/7/1999	4/7/1999
To:	J. Panebianco	J. Panebianco	J. Panebianco	J. Panebianco	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz
From:	S.M. Solomon	S.M. Solomon	S.M. Solomon	S.M. Solomon	Dorian Bailey	Dorian Bailey	Dorian Bailey
Building	1WTC	1WTC	1WTC	1WTC	1 WTC	1 WTC	1 WTC
Floor	Elevator Shaft 12A/13A	Elevator Shaft 12A/13A	Elevator Shaft 12A/13A	Elevator Shaft 12A/13A	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11
Location/Test Area	78th Floor Transverse Beam	40th Floor Transverse Beam	20th Floor Transverse Beam	1st Floor Transverse Beam	Columns Basement to 1st Floor	Beams 1st Floor	Columns 2nd Floor
Minimum Thickness Required	Not Cited	Not Cited	Not Cited	Not Cited	0.50	0.75	0.50
Reported Mean, inches	**1.50**	**1.00**	**0.65**	**0.60**	**0.88**	**1.06**	**0.82**
Discrete Gage #1	Discrete	Discrete	Discrete	Discrete	1	1 1/4	1
Discrete Gage #2	Measurements	Measurements	Measurements	Measurements	3/4	1 1/4	1
Discrete Gage #3	not available	not available	not available	not available	3/4	7/8	7/8
Discrete Gage #4					1	1 1/4	5/8
Discrete Gage #5					1 1/8	3/4	1/2
Discrete Gage #6					1 1/8	1 5/8	5/16
Discrete Gage #7					3/4	1	1
Discrete Gage #8					1 1/8	1 1/8	1
Discrete Gage #9					1 1/8	1	1 1/8
Discrete Gage #10					1	1 1/8	1
Discrete Gage #11					1	1 1/4	3/4
Discrete Gage #12					3/4	3/4	7/8
Discrete Gage #13					1 1/8	5/8	
Discrete Gage #14					5/8	1 1/8	
Discrete Gage #15					5/8	1	
Discrete Gage #16					1/2	1	
Discrete Gage #17					7/8		
Discrete Gage #18					5/8		
Re-Calculated Mean, inches					**0.88**	**1.06**	**0.84**

PA Materials Engineering

Discrete Thickness Values
Historical WTC Fireproofing
Elevator Shaft Results

Date of Report	4/7/1999	4/7/1999	4/7/1999	4/7/1999	4/7/1999	4/7/1999	4/7/1999	4/7/1999
To:	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz
From:	Dorian Bailey	Dorian Bailey	Dorian Bailey	Dorian Bailey	Dorian Bailey	Dorian Bailey	Dorian Bailey	Dorian Bailey
Building	1 WTC	1 WTC	1 WTC	1 WTC	1 WTC	1 WTC	1 WTC	1 WTC
Floor	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11
Location/Test Area	Beams 2nd Floor	Columns 6th Floor	Beams 6th Floor	Columns 11th Floor	Beams 11th Floor	Columns 16th Floor	Beams 16th Floor	Columns 20th Floor
Minimum Thickness Required	0.75	0.50	0.75	0.50	0.75	0.50	0.75	0.50
Reported Mean, inches	**0.93**	**0.75**	**0.97**	**0.88**	**0.93**	**0.78**	**0.94**	**0.79**
Discrete Gage #1	1 1/8	3/4	1	3/4	1	3/4	1	7/8
Discrete Gage #2	7/8	3/4	1 1/4	1	1	3/4	3/4	5/8
Discrete Gage #3	1 1/4	5/8	1 1/4	11/16	3/4	1/2	3/4	7/8
Discrete Gage #4	7/8	3/4	1	11/16	1 1/8	1/2	1	3/4
Discrete Gage #5	1 1/8	1	1 1/4	1	1	3/4	3/4	1
Discrete Gage #6	3/4	3/4	1	1	7/8	1	7/8	1
Discrete Gage #7	1	3/4	1	1	1	7/8	7/8	1
Discrete Gage #8	1/2	5/8	5/16	3/4	3/4	5/8	1 1/4	3/4
Discrete Gage #9	3/4	3/4	1	5/8	3/4	5/8	7/8	5/8
Discrete Gage #10	3/4	5/8	3/4	1	1	1/2	1 1/8	5/8
Discrete Gage #11	1	3/4	1	3/4	15/16	5/8	1 1/8	3/4
Discrete Gage #12	3/4	1		3/4		1	1	3/4
Discrete Gage #13		5/8		3/4		1	1	5/8
Discrete Gage #14		3/4		5/8		7/8		
Discrete Gage #15				5/8		1		
Discrete Gage #16						7/8		
Discrete Gage #17								
Discrete Gage #18								
Re-Calculated Mean, inches	**0.90**	**0.75**	**0.98**	**0.80**	**0.93**	**0.77**	**0.95**	**0.79**

PA Materials Engineering

Discrete Thickness Values
Historical WTC Fireproofing
Elevator Shaft Results

Date of Report	4/7/1999	4/7/1999	4/7/1999	4/7/1999	4/7/1999	4/7/1999	4/7/1999	4/7/1999
To:	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz
From:	Dorian Bailey	Dorian Bailey	Dorian Bailey	Dorian Bailey	Dorian Bailey	Dorian Bailey	Dorian Bailey	Dorian Bailey
Building	1 WTC	1 WTC	1 WTC	1 WTC	1 WTC	1 WTC	1 WTC	1 WTC
Floor	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 10/11
Location/Test Area	Beams 20th Floor	Columns 25th Floor	Beams 25th Floor	Columns 30th Floor	Beams 30th Floor	Columns 35th Floor	Beams 35th Floor	Columns 41th Floor
Minimum Thickness Required	0.75	0.50	0.75	0.50	0.75	0.50	0.75	0.50
Reported Mean, inches	**1.07**	**0.87**	**0.96**	**0.88**	**0.93**	**0.80**	**0.97**	**0.92**
Discrete Gage #1	1 1/8	15/16	3/4	1 1/2	1 1/8	1 1/8	1 1/4	1
Discrete Gage #2	1	1	1	1	1	1	3/4	3/4
Discrete Gage #3	1 1/4	31/32	3/4	1	7/8	5/8	1 1/8	3/4
Discrete Gage #4	1	1	1 3/8	1	15/16	15/16	1	3/4
Discrete Gage #5	3/4	1 1/4	1 1/4	7/8	1 1/4	3/4	1 1/4	1
Discrete Gage #6	7/8	1 1/8	7/8	3/4	1 1/4	1	1 1/4	7/8
Discrete Gage #7	1 1/8	3/4	1	7/8	7/8	7/8	3/4	1
Discrete Gage #8	1	3/4	3/4	3/4	3/4	7/8	7/8	1
Discrete Gage #9	7/8	1	7/8	1	3/4	3/4	7/8	1
Discrete Gage #10	15/16	1	1 1/4	3/4	7/8	1/2	3/4	1
Discrete Gage #11	7/8	1	3/4	7/8	3/4	5/8	3/4	
Discrete Gage #12	1 1/8	1/2	1	1/2	15/16	1	7/8	
Discrete Gage #13	1	7/8	3/4	3/4	5/8	1/2	1	
Discrete Gage #14	1			1/2	3/4	1/2		
Discrete Gage #15				15/16		1/2		
Discrete Gage #16								
Discrete Gage #17								
Discrete Gage #18								
Re-Calculated Mean, inches	**1.00**	**0.94**	**0.95**	**0.87**	**0.91**	**0.77**	**0.96**	**0.91**

Discrete Thickness Values
Historical WTC Fireproofing
Elevator Shaft Results

Date of Report	4/7/1999	4/7/1999	8/4/1997	8/4/1997	8/4/1997	8/4/1997	8/4/1997
To:	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz	Eli Moscovitz
From:	Dorian Bailey	Dorian Bailey	John Bullard	John Bullard	John Bullard	John Bullard	John Bullard
Building	1 WTC	1 WTC	1 WTC	1 WTC	1 WTC	1 WTC	1 WTC
Floor	Elevator Shaft 10/11	Elevator Shaft 10/11	Elevator Shaft 14/15	Elevator Shaft 14/15	Elevator Shaft 14/15	Elevator Shaft 14/15	Elevator Shaft 14/15
Location/Test Area	Beams 41th Floor	Columns 45th Floor	Basement to 5th Floor	5th to 20th Floor	20th to 54th Floor	54th to 68th Floor	68th to 80th Floor
Minimum Thickness Required	0.75	0.50	0.50	0.50	0.50	0.63	0.88
Reported Mean, inches	**1.01**	**0.75**	**0.75**	**0.80**	**0.85**	**0.90**	**1.00**
Discrete Gage #1	1 1/4	5/8	Discrete	Discrete	Discrete	Discrete	Discrete
Discrete Gage #2	1	5/8	Measurements	Measurements	Measurements	Measurements	Measurements
Discrete Gage #3	1 1/4	7/16	not available	not available	not available	not available	not available
Discrete Gage #4	1 1/4	5/8					
Discrete Gage #5	1 1/4	5/8					
Discrete Gage #6	1	5/8					
Discrete Gage #7	1/2	1					
Discrete Gage #8	1/2	1					
Discrete Gage #9	1	7/8					
Discrete Gage #10	1	1					
Discrete Gage #11	1						
Discrete Gage #12	7/8						
Discrete Gage #13							
Discrete Gage #14							
Discrete Gage #15							
Discrete Gage #16							
Discrete Gage #17							
Discrete Gage #18							
Re-Calculated Mean, inches	**0.99**	**0.74**					

Primary Org PA

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Letter Lombardi to NIST regarding fire protection of columns

Include work order no. and floor no. if applicable

Roll #:	**Doc. ID (report #, dwg. #):**	
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KEYWORDS – HIGHLIGHT ALL THAT APPLY

Level 1

Bankers Trust	Project 5	WTC 3 - Marriot Hotel
Below Grade	Project 6	WTC 4 - South Plaza Bldg.
Concourse	Project 7	WTC 5 - North Plaza Bldg.
Electrical Substation	Project 8	WTC 6 - Customs House
Liberty Plaza	WFC 1 - Oppenhiemer Dow	WTC 7
PATH Station	WFC 2 - Tower B	WTC Complex
Project 1	WFC 3 - American Express	WTC Plaza
Project 2	WFC 4 - Tower D	
Project 3	WTC 1 - North Tower	Add
Project 4	WTC 2 - South Tower	

Level 2

Accident analysis & risk	Fire protection	Misc. Performance Problems	Tenant alterations
Architectural	Fire service	News coverage	Tenant Space
Data request	Landscaping	Police	Add
Emergency management	Management	Security	
Evacuation	Mech./elec.	Structural	

Level 3

1993 explosion	Deck	Hat truss	Shop drawings
A/E fitout	Deflection	Human comfort	Shortening
A-242	Demolition	HVAC	Slab
A-36	Design	Index	Slurry wall
A-497	Detailing	Inspection	Smoke control
Aircraft impact	Doors	Insulation	Smoke test
Air cooled condensers	Drawings	Job number	Spandrel beam
Analysis	Eastern States Steel	Joist	Specifications
Angles	Egress	L-50	Splices
Antenna	Elevator	Lighting	Sprinkler
Artifacts	Emergency communications	Loads	Stability
Asbestos	Equipment	Maintenance	Stairways
Base plate	Erection marks	Marking	Standards
Beams	Escalator	Mesh reinforcement	Steel
Bid Invitation	Expansion joint	Mill inspection	Steel composition
Bow tie	Exterior columns	Model	Stiffness
Bracing	Fabrication	Mullion	Structural review
Bridging truss	Family member	Operations	Survivor
Calculations	Field survey	Paint	Tenant list
Carpet	Fire alarms	Partition layout	Testing
Ceilings	Fireproofing	Partitions	Tie
Certification	Fire spread	Photos	Tolerances
Chillers	Fire testing	Pipes	Transfer Girders
Cladding	Flag Pole	Plumbing	Triad
Collapse	Flammability	Prestressing	Truss
Columns	Floor	Probability, uncertainty	Vestibule
Communication systems	Floor load	Quality control	Vibration
Composite truss	Floor slab	Ramp	Walls
Computer output	Floor system	Reinforcing (strengthening)	Water supply
Computer program	Floor trusses	Renovation	Weather
Concrete	Foundations	Repair	Weight
Connections	Fracture	Research & Development	Weld detail
Construction	Frame	Roof	Weld size
Contract	Frame analysis	Safety	Welding
Core beams	Frequency	Schedule	Wind
Core columns	Fuel	Sculpture	Windows
Cranes	Furniture layout	Security system	Yield strength
Criteria	H Generators	Shear knuckle	
Dampers	Guidelines	Shear test	Add
Debris	Gypsum board	Shear Stud	